

The C6 nerve root could be injured during the C7 transforaminal epidural injection procedure.

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Introduction

Cervical transforaminal epidural steroid injections (C-TFESI) are conducted for the management of axial neck pain and upper extremity radiating pain. Generally the C-arm guided procedures are performed, but the soft tissue structures, such as nerve roots or vessels, could not be visualized. The ultrasound guided periradicular injections are performed to overcome the risk of complications. However, the ultrasound guided procedure has limitation of extraforaminal injection. When performing C7 TFESI, many patients complaints the radiating pain on C6 dermatome. This is a pilot study investigating the location of C6 nerve root in the C-arm guided C7 TFESI. We assessed the risk of C6 nerve root injury during C7 TFESI using the ultrasonography.

Method

This pilot study was carried out on the cadavers and the healthy volunteers. We performed the C7 transforaminal epidural needle insertion on the bilateral neck of two fresh cadavers (4 cases of TFESI). Under the C-arm guidance, the needle was inserted in 45 degree and targeted to the anterior to the superior articular process (SAP). After the needle was located in the middle of lateral mass in AP view, we performed the ultrasonography for the evaluation of relation between the needle position and C6 nerve root location. We also performed the ultrasonographic examination on the bilateral neck of ten healthy volunteers (20 cases). The location of C6 nerve root was evaluated using ultrasonography at the level of C7 foramen (SAP level). The subjects were performed the ultrasonography in supine position with neck rotation to the contralateral side. The probe was applied on the bilateral neck of the healthy volunteers in 45 degree with minimal pressure. We defined the virtual needle pathway in C7 TFESI as the space between the anterior border of SAP and the posterior border of internal jugular vein and vertebral artery. If the C6 root located within the virtual needle pathway area, we assessed that there is a risk of injury during the TFESI. If the C6 root located out of the virtual needle pathway, we measured the distance between the anterior borders of SAP and C6 nerve root.

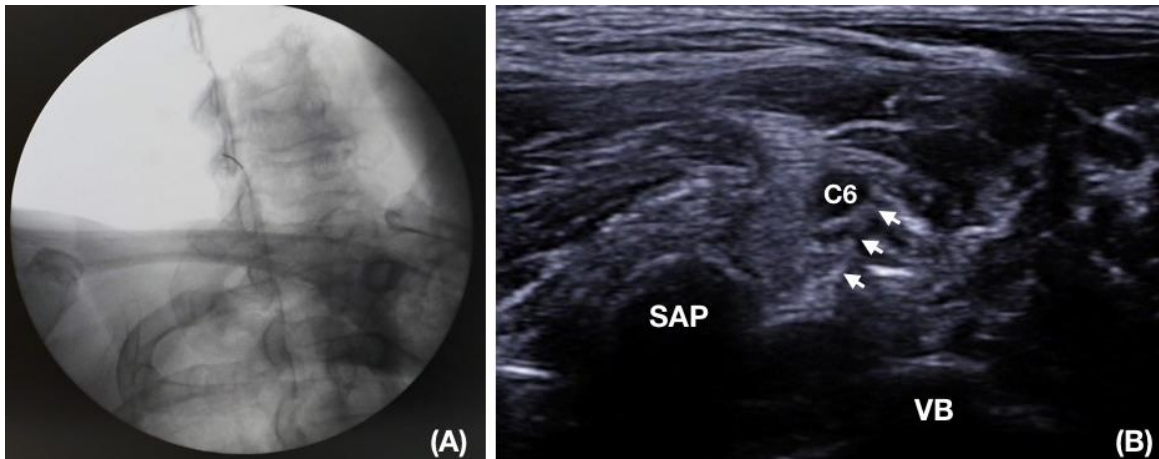
Results

In cadaver study, there was one case in which the C6 nerve root was contact with the needle on the ultrasonographic examination after C7 TFESI. In this case, the C6 nerve root located anterior to the SAP. In other 3 cases, the C6 nerve root located posterior to the anterior border of SAP and away from the needle pathways. In human study, there were 8 cases in which the C6 nerve root was located in the risk zone of injury. However, there

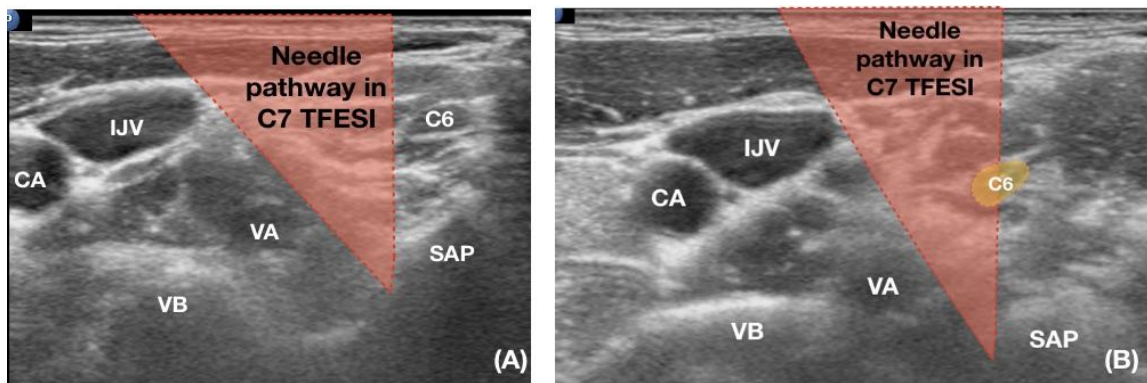
was no case that the C6 nerve root located fully anterior to the SAP. In other 12 cases, the mean distance between the C6 nerve root and the SAP was 4.9 ± 2.5 mm.

Conclusion

This pilot study indicates that the C6 nerve root injury could occur during the C-arm guided C7 TFESI. Careful assessment should be needed about the location of C6 nerve root before the C7 TFESI.



Cadaver study. (A) shows the C7 transforaminal epidural needle insertion under C-arm guide. (B) shows the ultrasonographic findings after the needle insertion. The C6 nerve root contacts with the needle (arrows). VB, vertebral body; SAP, superior articular process.



Ultrasonographic examinations. (A) The C6 nerve root locates outside of the virtual needle pathway. (B) The C6 nerve root locates within the needle pathway. CA, carotid artery; IJV, internal jugular vein; VA, vertebral artery; VB, vertebral body; SAP, superior articular process.

No.	Gender	Age (yr)	Height (cm)	Weight (kg)	Body Mass Index	Risk of injury	Side	Distance between C6 and SAP (mm)
1	M	30	170	70	24.22	Y	R	
	M	30	170	70	24.22	Y	L	
2	M	52	173	70	23.39	N	R	8.22
	M	52	173	70	23.39	Y	L	
3	F	39	165	55	20.2	Y	R	
	F	39	165	55	20.2	N	L	5.57
4	F	30	165	50	18.37	N	R	4.9
	F	30	165	50	18.37	N	L	1.34
5	M	39	178	88	27.77	N	R	2.32
	M	39	178	88	27.77	Y	L	
6	F	46	160	53	20.7	N	R	8.07
	F	46	160	53	20.7	Y	L	
7	F	38	170	52	17.99	N	R	0.37
	F	38	170	52	17.99	Y	L	
8	M	27	171	68	23.26	N	R	4.68
	M	27	171	68	23.26	Y	L	
9	M	31	172	80	27.04	N	R	6.61
	M	31	172	80	27.04	N	L	5.17
10	M	26	172	62	20.96	N	R	5.22
	M	26	172	62	20.96	N	L	6.92

The demographic characteristics, risk assessments and distance measurements of 10 healthy volunteers.